LAPAROSCOPY- ASSISTED ANORECTOPLASTY FOR ANORECTAL MALFORMATIONS

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CERTIFICATE

This is to certify that this dissertation titled '**LAPAROSCOPY- ASSISTED ANORECTOPLASTY FOR ANORECTAL MALFORMATIONS'** is a bonafide work of **Dr.D.VIJAYAGIRI**, submitted for the qualifying examination in M.Ch., Paediatric Surgery, to be held in August 2007 by the **Dr. M.G.R. MEDICAL UNIVERSITY.**

Signature of the H.O.D

Signature of the Dean

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I am deeply indebted to our Deputy Superintendent and my Chief **PROF. V. KUMARAN, M.S., M.Ch.,** Professor and Head of the Department of Paediatric Surgery, Coimbatore Medical College Hospital, Coimbatore, but for whose guidance, this study would not have come through. It has been a great privilege to work under him and especially on this topic.

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This study would not have seen the light of the day, had not our patients showed the kind co-operation they extended. I sincerely thank them.

LAPAROSCOPY- ASSISTED ANORECTOPLASTY FOR ANORECTAL MALFORMATIONS

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INTRODUCTION

POSTERIOR SAGITTAL ANORECTOPLASTY (PSARP), popularized by de Vries and Pena[1] has become standard surgical management of imperforate anus. The PSARP involves incision from coccyx to perineal body, to widely expose the external sphincter, the levators, the rectum, and distal fistula to facilitate surgical repair. Despite excellent exposure of the anatomy and exact placement of the distal rectum within the muscle complex, continence often is less than ideal.

In an attempt to improve on these results Keith Georgeson[2] et al, in 2000 described a new surgical technique Laparoscopically Assisted Anorectal Pull-Through for High Anorectal malformations (LAARP) that utilizes a laparoscopic vantage point to reduce the amount of posterior dissection required for accurate placement of the bowel into the muscle complex. In our institution[3] we have been performing LAARP since 2001. The present study is intended to analyze this particular operative technique and examine the merits and demerits of this procedure.

AIMS OF THE STUDY

1. To analyze the usefulness of laparoscopy in management of High Anorectal malformations.

2. To discuss the operative technique performed in our institution.

3. To discuss various techniques described by others to identify centre of sphincter muscle complex (SMC) and placement of rectum within the centre of SMC.

4. To analyze the postoperative outcome in relation to continence, anorectal sensation & cosmetic appearance.

5. To discuss the complications related to LAARP.

MATERIALS AND METHODS

Study Design: This is a retrospective and prospective study analyzing Laparoscopically Assisted Anorectal Pull-Through for High

Anorectal malformations (LAARP) performed at Coimbatore Medical College Hospital.

Study period: January 2001 to March 2007

Study center: Study carried out at the Department of Paediatric surgery**, Coimbatore Medical College Hospital.**

Study Group: Totally 30 patients had undergone Laparoscopically Assisted Anorectal Pull-Through for Anorectal malformations (LAARP**)** at our department during the study period.

- Male – 26 Female -4
- Age group -2 months to 6 years
- TYPE of procedure
    - Staged procedure – 29 patients
    - Primary pull through – 1 child

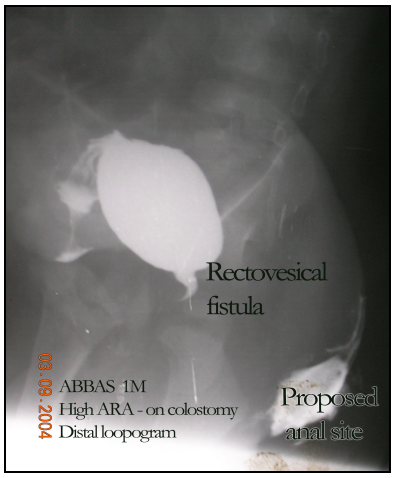
      (Recto vestibular fistula at 5 months of age)

EVALUATION

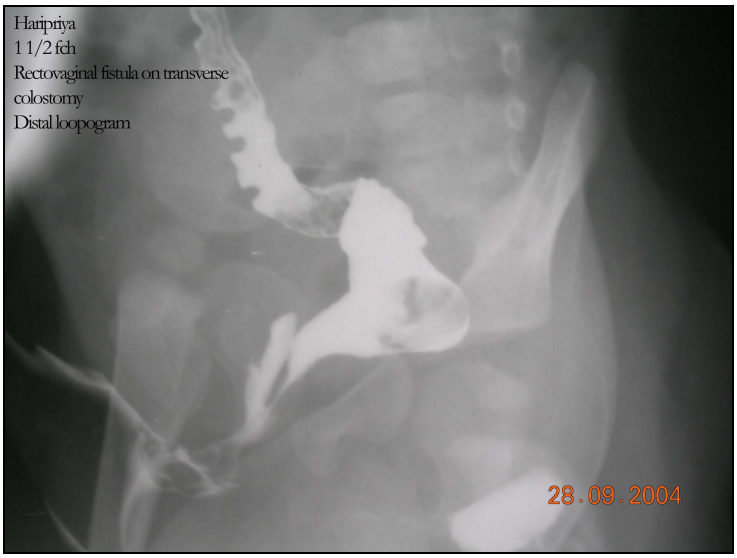
All patients were preoperatively evaluated with ECHO (echocardiogram), USG (ultrasonogram) abdomen, MCU (Micturating Cysto Urethrogram) and distal cologram to assess the cardiac status, genitourinary system and type of fistula respectively.

Recto urethral fistula

Recto vesical fistula



Recto vaginal fistula



TYPE OF REPAIR

One-stage repair

In the one-stage approach[4] no colostomy or mucous fistula is performed. Preoperative cystoscopy is a must to locate the fistula. One-stage laparoscopic repair is quite difficult particularly in new born. Several problems arise with this approach that can be technically demanding. The bowel wall can be particularly friable and thin walled; it also can be quite distended and can fill the entire pelvis, which makes laparoscopic dissection difficult. . Moreover, meconium evacuation from the bowel can be challenging. We have done a single case of primary single stage pull through in a child with recto vestibular fistula at 5 months of age.

Two-stage repair

The 2-stage repair colostomy involves initial creation of a sigmoid

colostomy and a mucous fistula followed by LAARP and stoma closure at the same second sitting.

Three-stage repair

This approach allows the repair, time to heal before passage of intestinal contents and subsequent anal dilatations. We prefer the three stage repair in our institution.

Operative technique

Set – up

Child is placed in the supine Trendelenburg position. The legs were draped using a sterile technique to allow the laparoscopic and perineal procedures to be performed simultaneously. Both the surgeon and assistant stand at the patients head while second surgeon (required at the later point in the operation) works at the feet. The patient was placed in lithotomy position with 15° head down tilt. All our patients received thorough distal loop wash out Peroperatively & given one dose of IV antibiotics during induction.

Anesthetic considerations

Several important points require the discussion between the surgeon and anesthesiologist preoperatively and these include the proper positioning of the patient, the placement of all monitoring devices, the choice of anesthesia, and

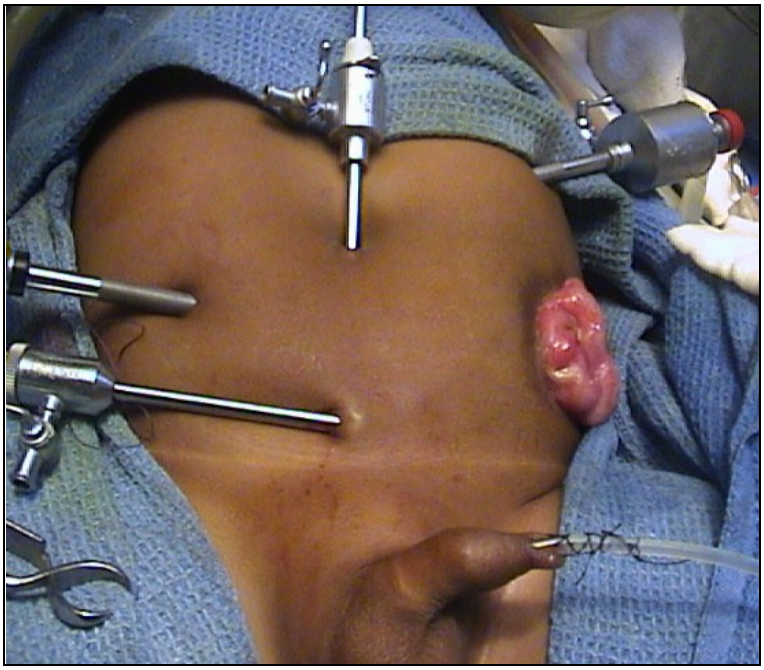
the need of intra venous access above the level of the nipples. We prefer ETGA with caudal block. Nitrous oxide should be avoided because it can distend the bowel, thereby decreasing the working space.

A nasogastric tube was introduced in the stomach and a urinary catheter introduced into the bladder. Often the catheter enters the fistula. If it occurs we use a rail road technique using urethral dilators under laparoscopic guidance to catheterize the bladder.

Port placement

Pneumoperitoneum with CO2 was created using a veress needle through the umbilicus and pressure was maintained at 8-12mm Hg. The abdominal cavity was accessed by 3 ports, one 4 or 5mm umbilical port for 30° telescope and two 5mm accessory working ports one at right lumbar region and another at left hypochondrium.

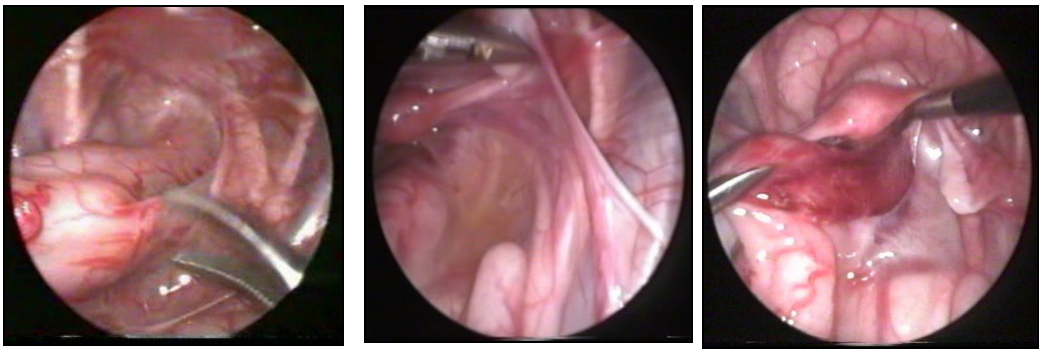
In difficult cases we placed an additional 3mm suprapubic port or a stay suture taken for retraction of the bladder. For better ergonomics[4] camera port can be placed just to right of midline below the liver edge particularly in neonates & small infants because of the small distance between the pelvis and the umbilicus.



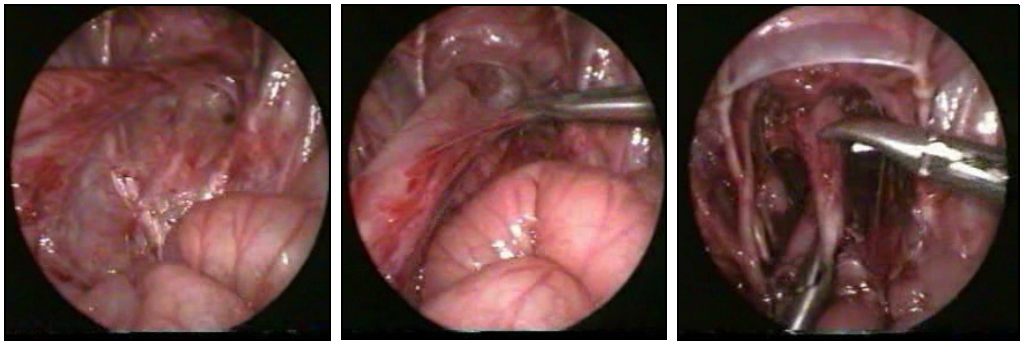
Rectal dissection

Operative technique is as described by Keith Georgeson[2] et al. The primary instruments for the pelvic dissection are a hook cautery, Maryland grasper atraumatic bowel grasper, and bipolar scissors. Early in the dissection, several adjunctive procedures may be helpful in providing accurate visualization.

A Hegar dilator placed in the mucous fistula can help to retract the rectum anteriorly, laterally, and posteriorly. Once in the pelvis, at the neck of the bladder, this maneuver is no longer helpful. The bladder, despite being decompressed, needs to be retracted anteriorly. Now, we use a transcutaneous bladder stitch using 2-0 silk suture which is inserted through the abdominal wall and tied against the skin, providing constant traction.



Dissection begins at the level of the peritoneal reflection. The blood supply to the sigmoid and rectum from the sigmoid and superior rectal arteries are preserved. The distal rectal peritoneal attachment was released with bipolar dissection and was continued anteriorly and laterally on the rectal wall taking care not to injure ureters and genital structures.

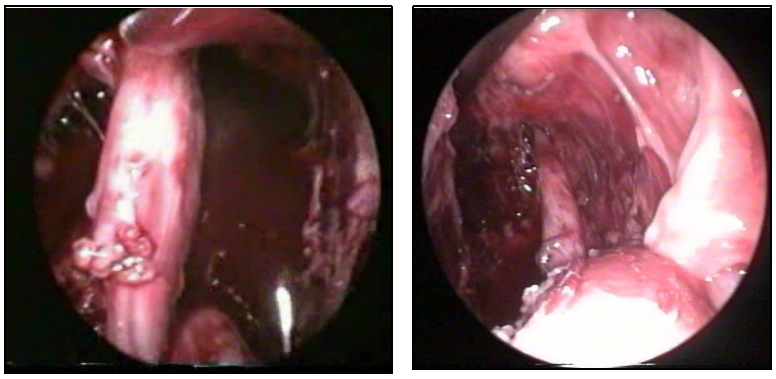


Posterior ***Lateral*** ***Anterior***

Fistula identification

Once the dissection has reached the level of the bladder neck, the bipolar scissors should be used rather than the hook cautery to avoid lateral damage to the pelvic nerves. Anterior dissection was stopped once the prostate in males and cervix uteri in females were visualized. Prostate is identified when both the

vas converge towards each other near the midline behind the urethra. The distal colon is dissected circumferentially leaving only the fistulous connection.



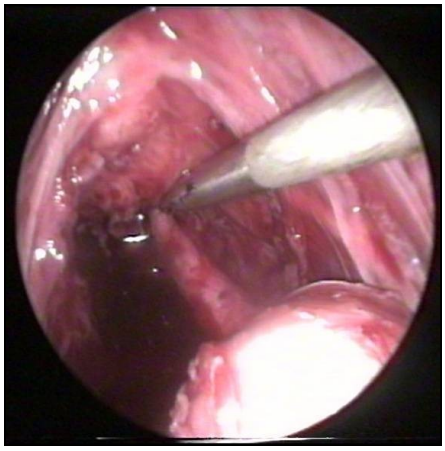
Recto urethral fistula Rectovaginal fistula

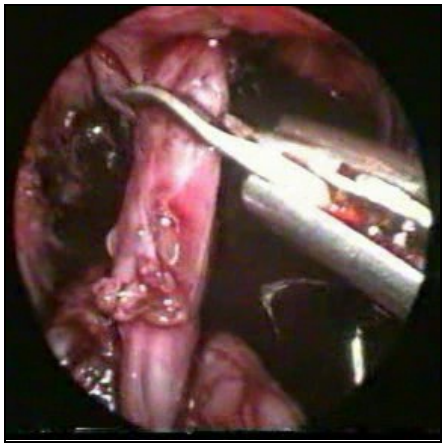
A bladder neck fistula is the easiest to dissect because it enters at virtual 90degree angle. A lower fistula is more difficult to dissect because of a common wall that is present between the lower rectum and the urethra. This can extend for several centimeters[5].

The fistula was dissected down up to the level needed i.e., where the coning or narrowing of the fistula occurs just before it joins the urethra or the vagina. Here we leave a small cuff of fistulous tissue before dividing it to prevent injury to the vaginal or urethral wall. By doing this we can avoid 1) injury to pelvic nerve plexus, 2) injury to the urethra or the vaginal wall.

In the initial 3 cases the fistulas were ligated and divided. In the subsequent cases the fistulas were divided without ligation. In case No. 4 we experienced difficulty in ligation of the fistula which was divided without ligation. Postoperative period was uneventful. Encouraged by this good result, in the

remaining cases the fistulas were divided without ligation.

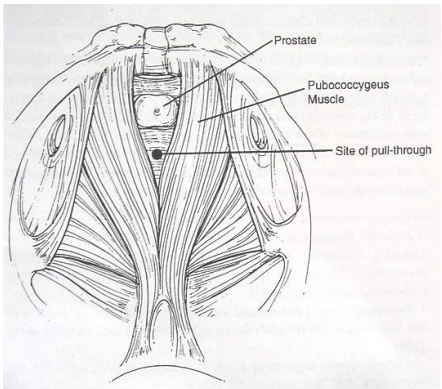


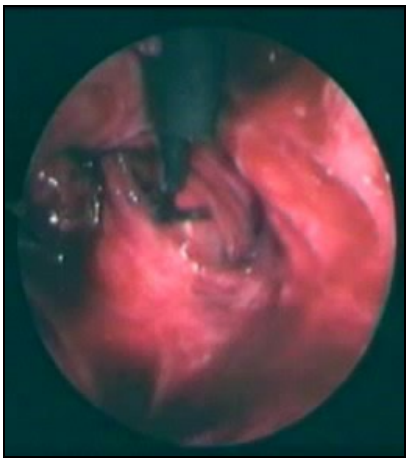


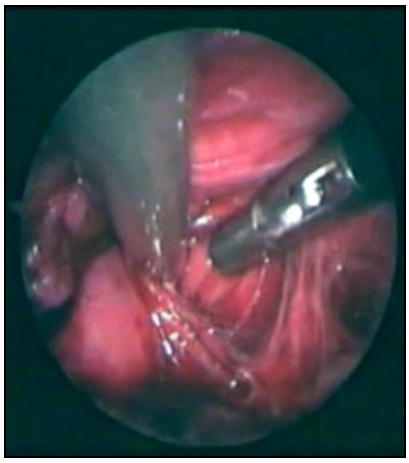
Fistula ligation ***Fistula division***

Creating Pull through canal

Divided bowel was retracted cephalad out of the pelvis. When 30 degree telescope is rotated 180 degree the underlying levator muscles in the pelvic floor can be seen clearly. Both bellies of pubococcygeus can easily be identified in relation to the urethra. The classic anatomic arrangement of the puborectails[2], resembling a **"sling –shot",** often can be appreciated. Ideally the contractility of the levator ani muscle and center of its two bellies is to be identified by using the laparoscopic muscle stimulator[6].







Muscle stimulation ***Pubococcygeus bellies***

In our department we improvised our conventional diathermy in a low setting current for muscle stimulation, as we do not possess a laparoscopic muscle stimulator. When there was insufficient muscle mass to clearly ascertain the pubococcygeus, the midline was identified, based on the position of the distal end of the divided fistula and the urethra.

Transcutaneous Electro stimulation ***Incision*** ***Suction Cannula through PTC***

Externally, the anal area of the perineum was mapped out using transcutaneous electro stimulation (muscle stimulator with 100-150 milliamps current). The area of maximal contraction and ventrocephalad elevation of the perineum was noted. The anterior, lateral and posterior limits of this anal area

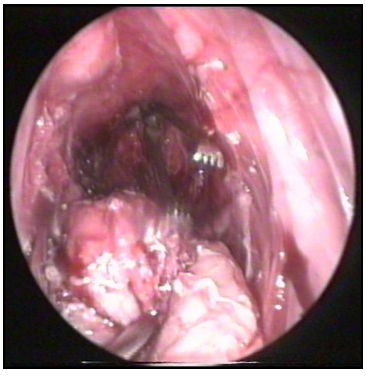
was marked with silk sutures, and a 12mm vertical midline incision was made in the perineum at the site of proposed anal orifice.

The intrasphincteric plane was dissected bluntly from below to the level of the levator sling using laparoscopic back light as guide from above. The dissected intrasphincteric plane was dilated with serial Hegar's dilators up to 10-12 mm size between the two bellies of the pubococcygeus muscle in the midline using laparoscopic guidance just posterior to the urethra.

Rectal Pull-through

A 10 mm trocar inserted through dilated tract into peritoneal cavity. The divided rectal fistula was grasped using an endo-babcock clamp and pulled onto the perineum through the newly created tract taking care not to twist the bowel. Anoplasty was done with 4-0 vicryl stitches without excising distal end of rectum. Finally the rectum was retracted cephalad laparoscopically and was secured to the presacral fascia with 2-0 silk sutures. This retraction lengthens the skin lined anal canal.

Dilating the PTC



Rectal pull through

Anoplasty

Postoperative care

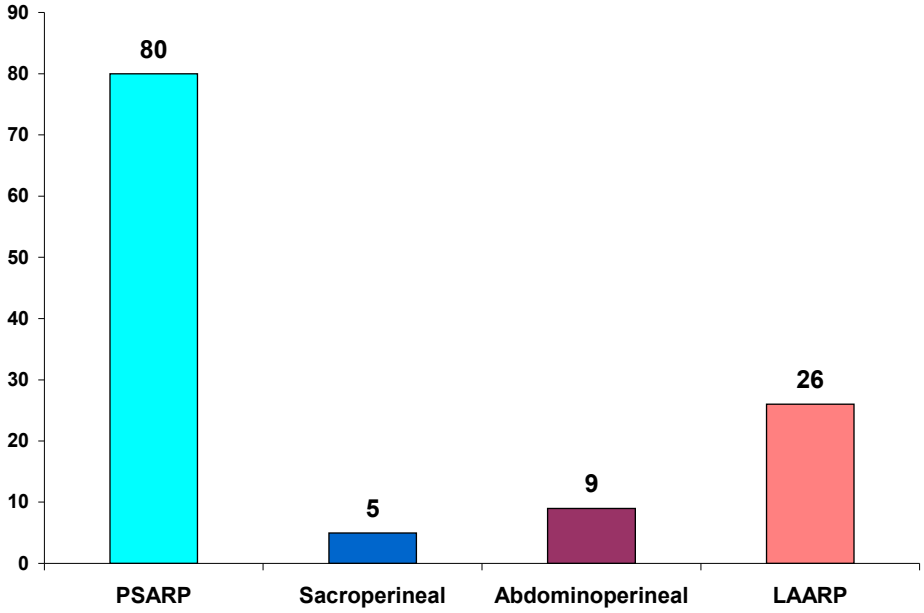
Postoperatively nasogastric tube decompression was maintained for 12 hours. Oral feeds and ambulation of the patients were started on the first postoperative day. Urethral catheter was removed on 7th Postoperative day. Anal dilatation was usually started on 10th postoperative day.

RESULTS

Hospital charts and surgical notes were reviewed in anorectal register in our institution from January 1998 to 2007. About 120 male patients & 80 female patients underwent definitive anorectal pull through repair for high & intermediate anorectal malformations.

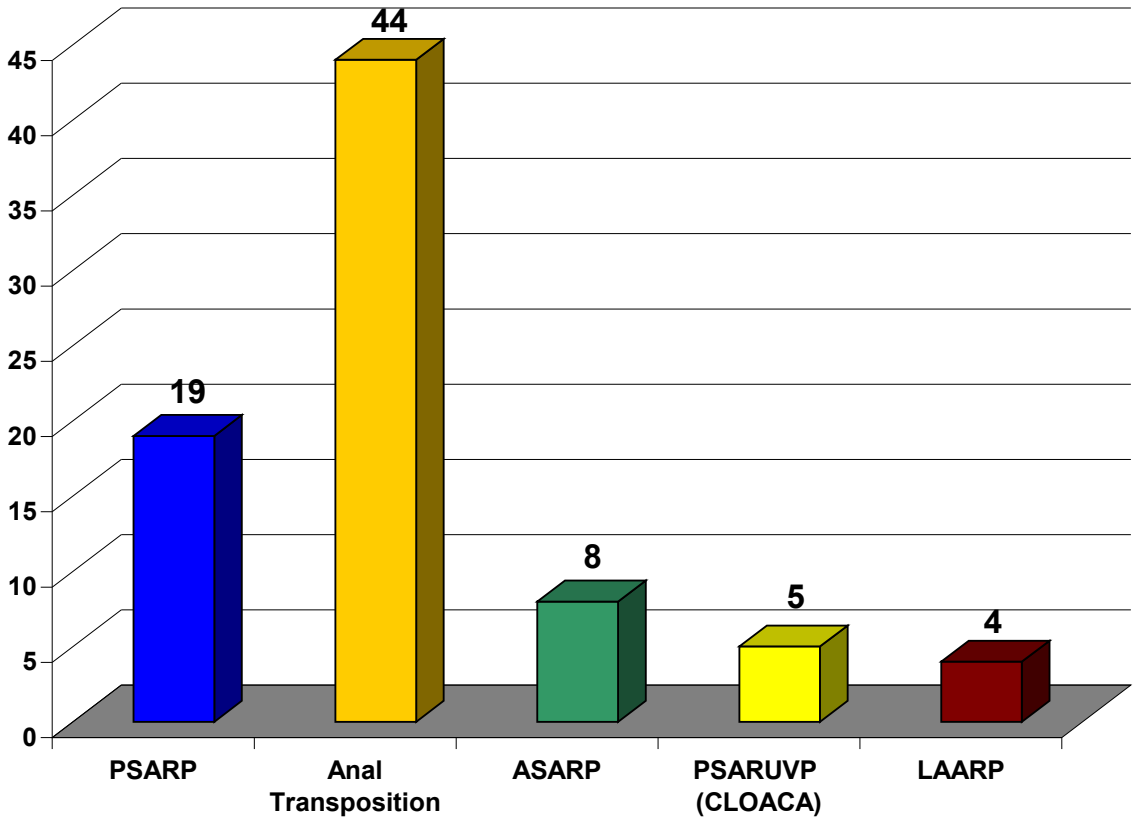
The type of definitive repair in male patients is shown below.

TYPE OF REPAIR	NO OF PATIENTS	PERCENTAGE
PSARP	80	66.66%
Sacroperineal	5	4.16%
Abdominoperineal	9	7.5%
LAARP	26	21.66%


90
80
70
60
50
40
30
20
10
0
80
5
9
26
PSARP
Sacroperineal
Abdominoperineal
LAARP

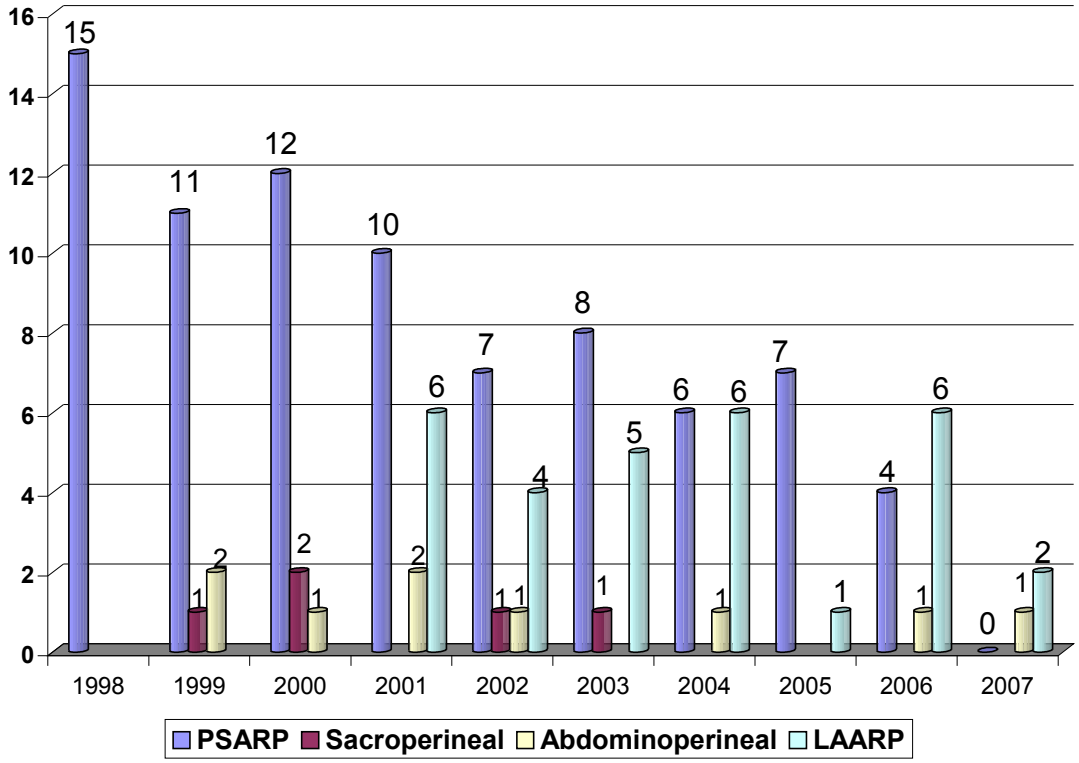
The type of definitive repair in female patients is shown below.

TYPE OF REPAIR	NO OF PATIENTS	PERCENTAGE
PSARP	19	23.75%
Anal Transposition	44	55%
ASARP	8	10%
PSARUVP (CLOACA)	5	6.25%
LAARP	4	5%



YEAR WISE DISTRIBUTION OF

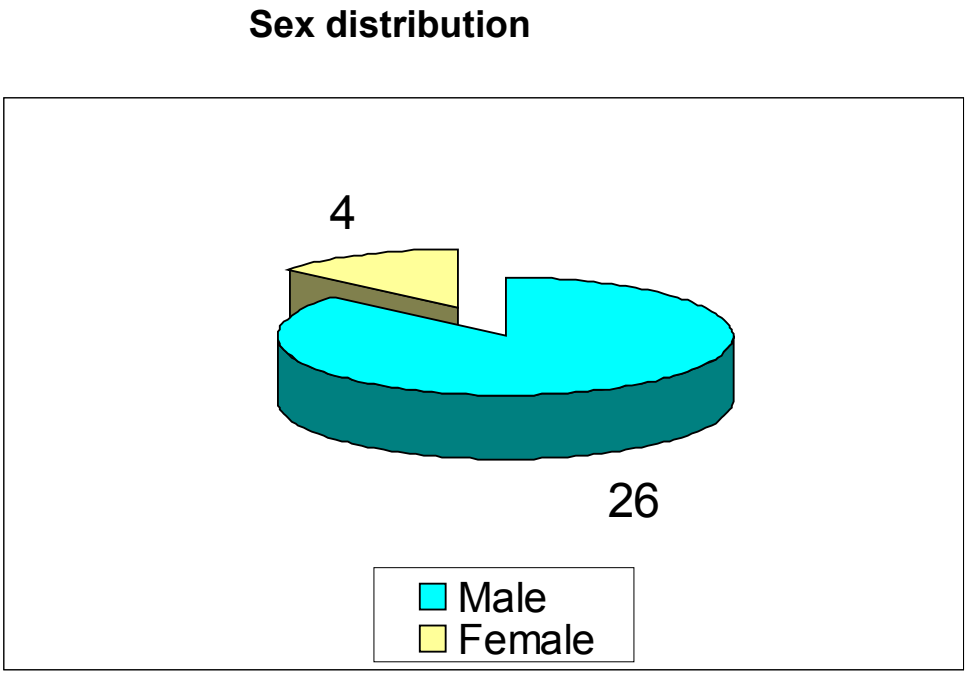
TYPE OF DEFINITIVE REPAIR IN MALE CHILDREN



PSARP is the commonly performed definitive repair for high anorectal malformation in our institution. However there is an increasing trend towards LAARP in recent years particularly in male children.

LAARP

Totally 30 patients had undergone Laparoscopically Assisted Anorectal Pull-Through for Anorectal malformations (LAARP) at our department during the study period from January 2001 to March 2007. There were 26 males and 4 females.

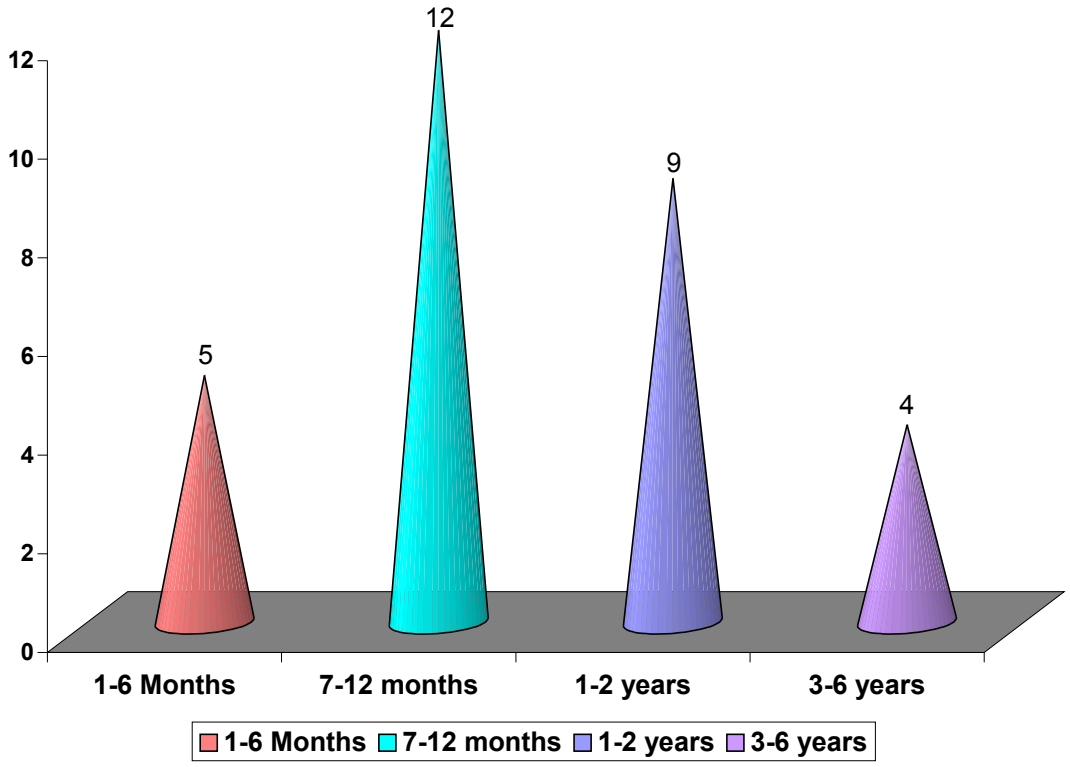


It is done as staged procedures in 29 patients and as a single stage pull through in one child with Recto vestibular fistula at 5 months of age.

AGE DISTRIBUTION

The age wise distribution of our patients is as follows

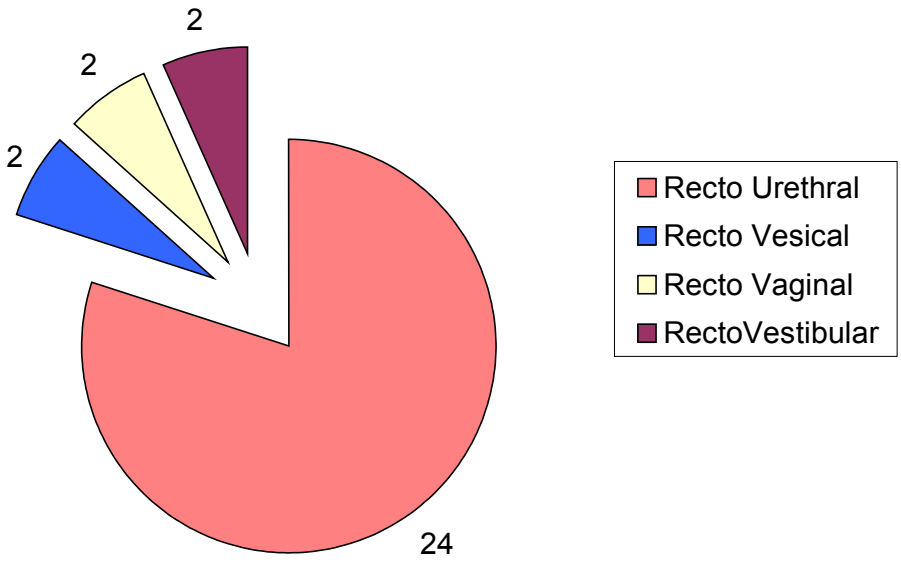
Age	No. of Cases	Percentage
1-6 Months	5	16.66%
7-12 months	12	40%
1-2 years	9	30%
3-6 years	4	13.33%



From this chart we can see that maximum number of child operated between age group of 7- 12 months of age.

TYPE OF FISTULA

TYPE OF FISTULA	NO OF PATIENTS	PERCENTAGE
Recto Urethral	24	80%
Recto Vesical	2	6.66%
Recto Vaginal	2	6.66%
Recto vestibular	2	6.66%



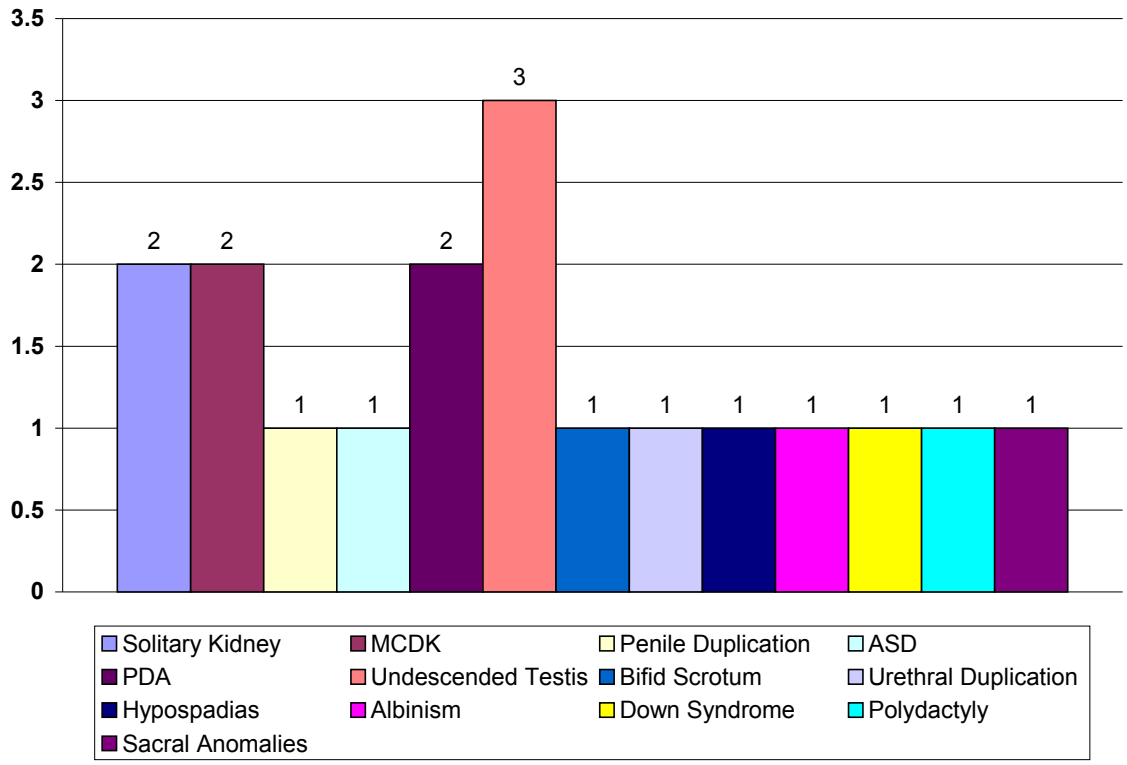
The maximum no of LAARP procedure was done for Recto urethral fistula.

ASSOCIATED ANOMALIES

ASSOCIATED ANOMALIES	NO OF CASES
Solitary Kidney	2
MCDK	2
Penile Duplication	1
ASD	1
PDA	2
Undescended Testis	3
Bifid Scrotum	1
Urethral Duplication	1
Hypospadias	1
Albinism	1
Down Syndrome	1
Polydactyly	1
Sacral Anomalies	1

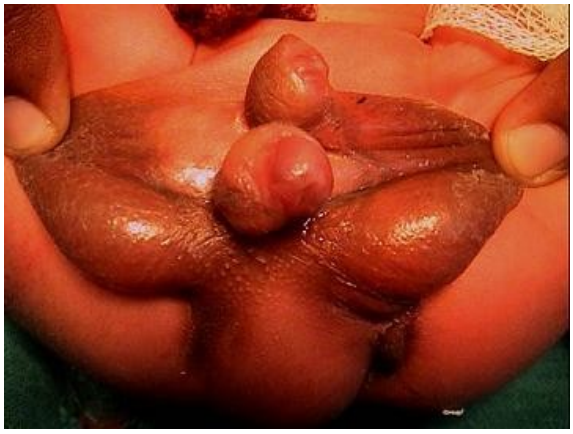
Genitourinary & cardiac lesions were the commonest associated anomalies in our series.

ASSOCIATED ANOMALIES



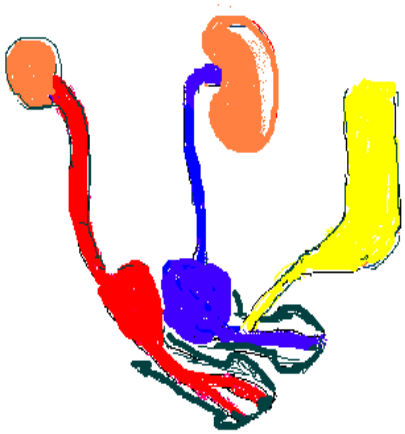
Among them we had an interesting rare associated lesion with combination of High ARA with double anal pit, PENILE DUPLICATION, Recto urethral fistula communicating to the upper phallus urethra, Y Type urethral duplication of lower phallus, Bladder duplication (upper phallic urethra joining the left half & lower one joining the right hemibladdder), Right dysplastic kidney draining the right hemi bladder, Left normal renal moiety joining the left hemibladdder & Bifid scrotum.

Preoperative perineal ultra sonogram showed muscle complex was situated towards left anal pit & pull through was performed towards the left anal pit.



Double Bladder **Distal loopogram**

Schematic Diagram



OPERATIVE RESULTS

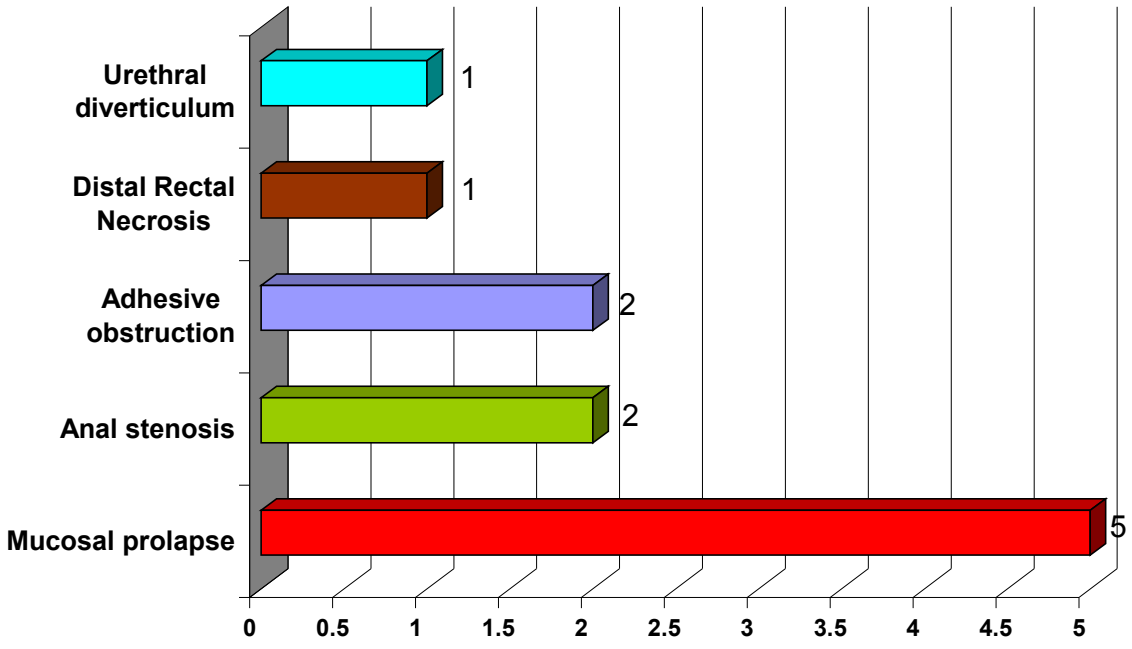
All the patients withstood surgery well. One patient required conversion

due to problem in gaining enough length for the distal rectum. This occurred in patient with rectovesical fistula & in this case colostomy was closed and recited at a proximal splenic flexure.

Normal looking neo anus

COMPLICATIONS

Complications	No of cases
Mucosal prolapse	5
Anal stenosis	2
Adhesive obstruction	2
Distal Rectal Necrosis	1
Urethral diverticulum	1



Mucosal prolapse

This is the commonest complication in our series which required mucosal trimming. This can be prevented by suturing rectum to presacral fascia while placing cephalad tension laparoscopically[2].

ANAL STENOSIS

This complication occurred in two cases. Posterior triangular anoplasty was needed in these two cases.

Adhesive obstruction

Two patients developed adhesive intestinal obstruction which was managed conservatively in one patient & another patient required laparotomy & adhesiolysis. There was a peroperative spill of distal rectal contents particularly barium in these two patients.

Distal Rectal Necrosis

This complication occurred in patient no 25. Peroperatively distal vascular branches to the rectum were sacrificed for adequate mobilization. This patient is waiting for a revision pull through.

Urethral diverticulum

This complication occurred in patient no 28, probably due to leaving behind a long stump of recto urethral fistula. Also patient had an associated left VUR. Patient is asymptomatic & on follow up.

Follow up

Patients were followed up with the following

- Clinical Evaluation
- Anal USG (ultra sonogram)
- CT pelvis
- MRI pelvis
- Manometry
- Distal loopogram

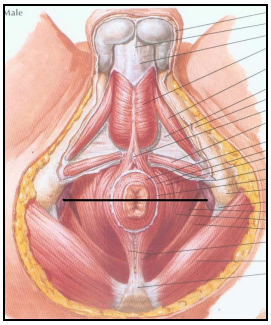
Clinical Evaluation

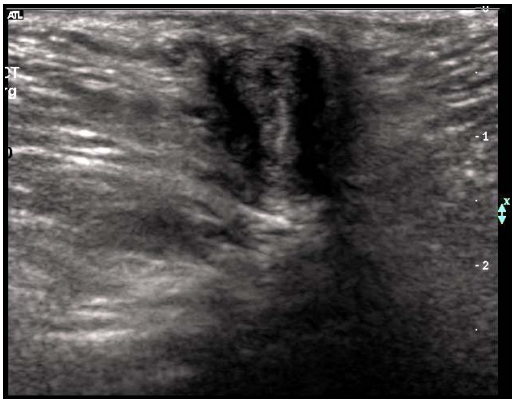
The progress has been satisfactory and weight gain was adequate. All our patients are passing formed stools 2-3 times a day and have symmetric anal contraction on stimulation and strong squeeze on digital rectal examination.

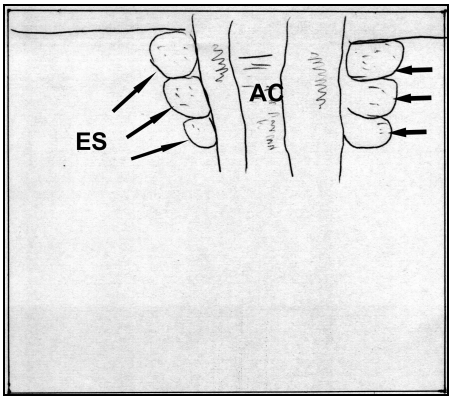
Anal USG (ultra sonogram)

Anal ultra sonogram was done in selected patients using high frequency probe & compared with normal individuals who showed a symmetric muscle complex on either side of pull through rectum.

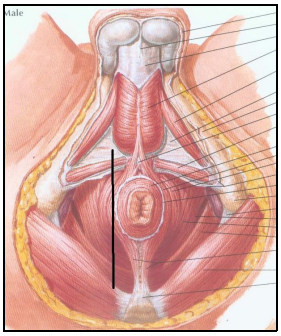
TRANSVERSE VIEW

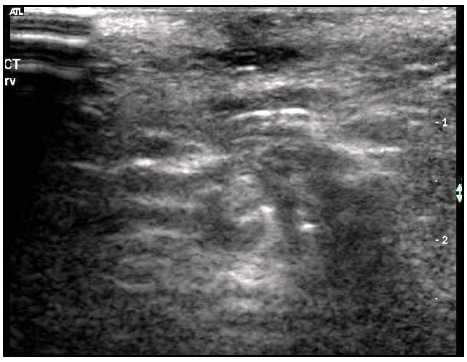






PARASAGITTAL VIEW




ATL
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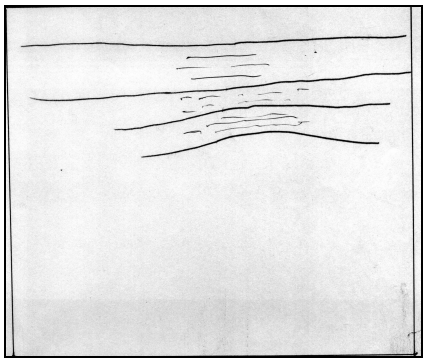
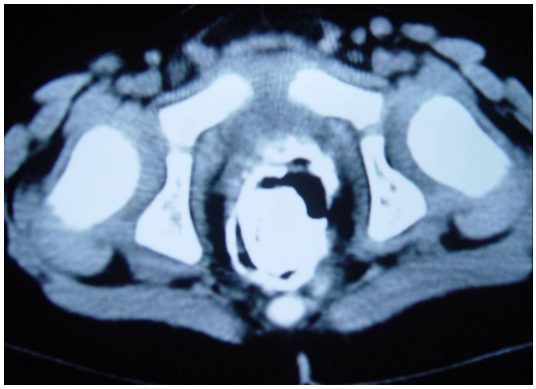


DISTAL LOOPOGRAM

Distal loopogram done prior to colostomy closure has shown a good anterior angulation of rectum which reflects accurate placement of rectum within the Puborectalis sling.

CT PELVIS

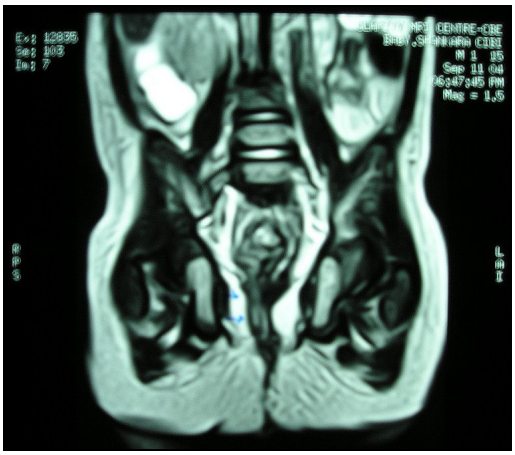
CT pelvis was done in selected affordable patients who showed the neo-rectum placed in the center of levator sling and within the anal sphincter.

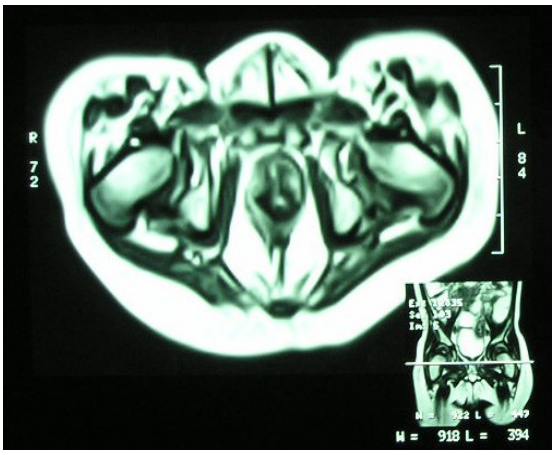



(202, 285)
R
WL = 40
WW = 400

MRI PELVIS

Similarly MRI pelvis was done in selected affordable patients who showed the neo-rectum placed in the center of levator sling and within the anal sphincter.





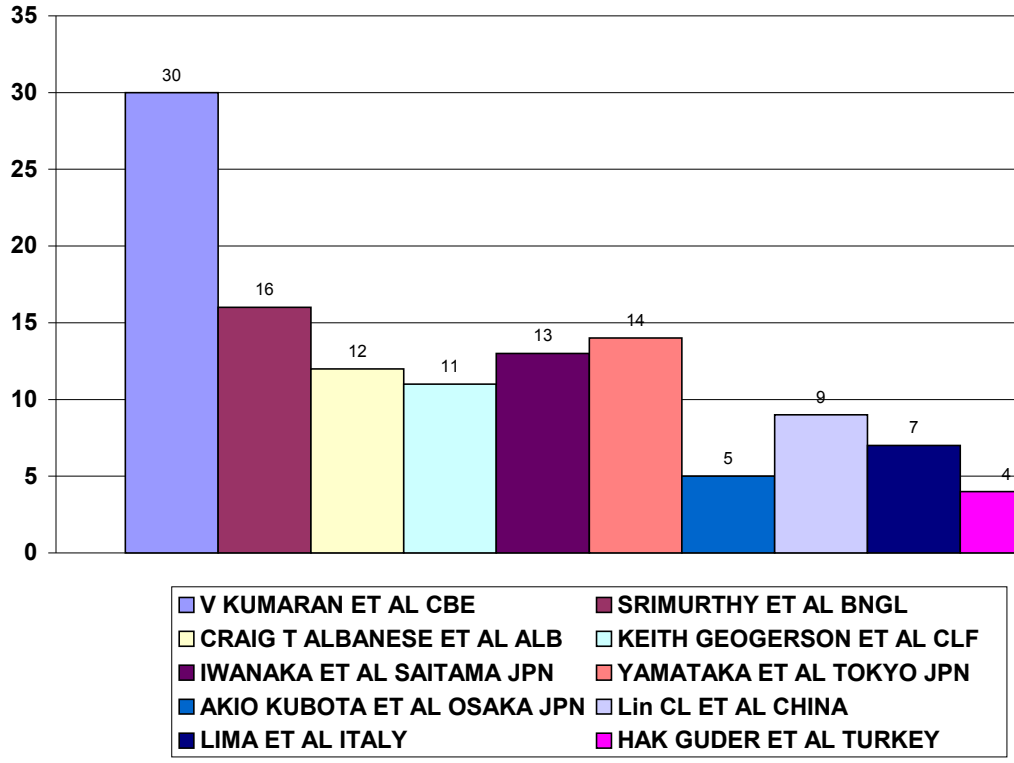
POSTOPERATIVE RESULTS

About 21 patients could be evaluated postoperatively according to International classification (Krickenbeck)[7] for Postoperative results and shown below.

1	**Voluntary bowel movements** (Feeling of urge, Capacity to verbalize, Hold the bowel movement)	**YES** **(15/21)**
2	**Soiling**	**GRADE 1 - 3/21 (No 8,13,16)** Occasionally (once or twice per week) **GRADE II - 1/21 (No 24)** Every day, no social problem **GRADE III - 1/21 (No 19)** Constant, social problem
3	**Constipation**	**GRADE 1 – Nil** Manageable by changes in diet **GRADE II - 2/21 (No 4,12)** Requires laxative **GRADE III - Nil** Resistant to laxatives and diet changes

REVIEW OF LITERATURE

The experience of different authors[2,4,8,9,10,11,12,13,14] in the world regarding LAARP is shown below.



The best comparative analysis between PSARP & LAARP patients was studied by **Lin CL**[11] et al from china. The defecation status and anorectal manometry of patients with high or intermediate type imperforate anus repaired with LARRP (n = 9) and age-matched patients repaired with PSARP (n = 13) were assessed and compared during the first year of postoperative follow-up evaluation.

The defecation status was classified by the frequency of bowel openings

(<1, 1-4, and >5 times per day). Manometric assessment[22] was performed. The presence of the recto anal relaxation reflex was determined, and the resting sphincteric pressure and resting rectal pressure were measured.

Seven of nine LARRP patients had an "acceptable" frequency of one to four bowel openings per day, in contrast to 7 of 13 PSARP patients. A positive RAR was detected in 88.9% (8/9) of the LARRP patients, and in only 30.8% (4/13) of the PSARP patients ($p < 0.01$). Moreover, a recto anal relaxation reflex was detected significantly earlier in LARRP than in PSARP patients.

Results concluded that in the early postoperative stage, patients repaired with LARRP had more favorable findings in anorectal manometry than patients repaired with PSARP.

DISCUSSION

Minimal access surgery has revolutionized the field of surgery in the last decade. Numerous laparoscopic operations are now performed both in adults and children. These new procedures have allowed access to body cavities without significantly traumatizing intervening tissue[31-32.]

The laparoscopically assisted anorectal pull-through (LAARP) for high anorectal malformations (ARM) uses fundamental concepts learned from decades of high ARM repair and additionally incorporates modern technologic advancements in surgical instrumentation and technique.

Pediatric surgeons[15-19] have long been challenged regarding the best way to restore anorectal function in infants born without an anus. Early in the 20th century, primary perineal anoplasty without colostomy was the most common repair for low lesions, and an anorectal pull-through procedure was used for high lesions. More recent advances have been made in surgical technique including the use of an endorectal pull through, an abdominoperineal pull through, and, later, the sacroabdominoperineal approach.

During this process, physiologic principles were learned that included knowledge of the normal rectal anatomy, the importance of the puborectalis sling in continence, and the placement of the rectum in to the levator muscles and through the puborectalis sling. The principles of adequate rectal

mobilization, avoidance of excessive pelvic floor disruption, and suture fixation of the bowel to the skin became accepted principle of any repair.

These early surgeons[17, 18] also believed that transaction of the sphincter muscles could be detrimental to future continence. How ever, clinical results suffered because, in many if these cases, identification and visualization of the levators and external sphincter muscle complex was not possible or was impaired, and the anorectum often was passed “blindly” into its final position.

Posterior sagittal anorectplasty (PSARP), Popularized by **deVries, and Pena**[1] revolutionized the management of infants with imperforate anus. Using a sagittal approach with an incision from the coccyx through the perineal body, all of the voluntary muscles of continence were identified in the midline and divided. This approach provided excellent visualization, protection of the urogenital structures[21], the ability to mobilize the bowel sufficiently, and identification of a urinary fistula. Outcomes in particular fecal continence[22], in patients with high lesions were improved using this approach.

Despite these improvements, the extent to which the muscle splitting dissection ultimately impairs overall anorectal functions is not clear. Even with excellent visualization of the anatomy and exact placement of the distal rectum within the muscle complex, continence often is less than ideal in patients with high fistulae[23-25] and may, at times, require concurrent laporotomy and

abdominoperineal pull through to identify and divide the urinary fistula.

In an attempt to improve on these results Keith Georgeson[2] et al hypothesized that, if an anatomic reconstruction of the ARM (such as that which results after PSARP) could be achieved with minimal surgical trauma to the continence mechanism (e.g., pelvic nerves and musculature), the clinical outcomes then might approach each individual's maximal potential for continence. Given the advantage of laparoscopy experienced in other pediatric intraabdominal operative procedures, a laparoscopic approach (LAARP) was developed.

Benefits of the procedure includes lack of division of the muscle complex, no need for laparotomy , decreased pain to the patient, and potentially less perineal wound complications. Additional advantages include repair of associated defect at operation (i.e., hernia, identification and repair of cryptorchid testes), superior pelvic visualization not possible with open surgery, and anatomic placement of the pull -through by identifying the central portion of the puborectalis from inside and the EAS from outside the patient.

PHYSIOLOGY

Normal continence is a result of a poorly understood, complex interplay between anatomic structures and physiologic forces in the pelvis. The major

factor is the influence of the pelvic musculature[35] on the configuration of the distal rectum and anal canal. When stool descends into the distal rectum, the recto anal inhibitory reflex is activated leading to relaxation of the IAS in response to the rectal pressure and the opening of the anal canal. Momentary simultaneous contraction of the EAS allows time for conscious decision to be made regarding defecation.

Understanding this physiology[33-34] and the pathology of ARM is important in performing an adequate repair. In patients with ARM, the muscle and sensory elements responsible for continence may be severely affected. The degree to which the dilated recto sigmoid colon has aganglionosis or dysganglionosis is debated with some investigators claiming virtual absence, whereas others use the fistulae in their repairs noting the presence of IAS fibers. In high ARM, development of a normal IAS may not occur.

As a result patients have a greater reliance on the striated muscle complex for maintenance of continence and therefore preservation of these muscles is vital for success after any operative repair. It is important to recognize that abnormal development of the levator ani muscle, the IAS, the EAS, and the nerves inverting them maybe as important as or more important than the surgical repair in subsequent continence for the infant with an ARM.

Pull Through Canal (PTC)

Creating an accurate Pull through canal (PTC) without dividing muscle fibers is the **key step** for a successful repair in LAARP. An ideal pull through canal must be **symmetrically surrounded** by all the pelvic floor muscles (the external anal sphincter, the muscle complex, and the levator sling).

Georgeson et al dissects the intrasphincteric plane bluntly from the site of the proposed anus to the level of the levator sling during LAARP using laparoscopic backlighting. This blunt dissection toward the laparoscopic light source facilitates the creation of an adequate pull-through canal.

Laparoscopic Muscle Stimulator

Yamataka[6] et al in 2001 reported that direct laparoscopic observation of levator ani contraction allows intraoperative assessment of functional contractility and assists in the accurate placement of the colonic pull-through. He performed laparoscopic or intraperitoneal electro stimulation of the levator ani muscle sling, by passing a muscle stimulator (Pen˜a Muscle[27] Stimulator, Radionics, Inc, Burlington, MA) through the umbilical 12-mm trocar to identify the center of contraction of the levator ani muscle sling.

Direct muscle stimulation was performed at a current intensity of 60 milliamps. Another team from perineal side also used the same Pen˜a muscle stimulator but transcutaneously at an intensity of between 100 and 150 milliamps to identify the proposed anus. A 20-gauge indwelling intravenous

cannulation device (SURFLO Flash IV catheter, Terumo Co, Ltd., Yamanashi, Japan) then was inserted through the center of contraction of the external sphincter muscle at the site of the proposed anus.

Meanwhile, team from above was able to observe the SURFLO piercing between the 2 bellies of the levator ani muscle sling in the midline through the laparoscope. The muscle sling again was electro stimulated laparoscopically to confirm that the position of the SURFLO was optimal. A guide wire was passed through the SURFLO, and a series of dilators of increasing size were passed along the guide wire to create a pull-through canal. The colon then was pulled through, and an anoplasty was performed.

The advantage of this technique is that the center of the levator ani muscle sling contraction can be viewed directly, and the strength of muscle contraction can be assessed functionally, facilitating the creation of the pull-through canal. Muscle relaxants do not interfere with the muscle response to direct electrical stimuli[26] so muscle contraction seen laparoscopically in response to electro stimulation can be assumed to be a direct representation of muscle contractility.

Transcutaneous stimulation is used to identify the proposed anus and is insufficient for stimulating the levator ani. “Intraperitoneal” electro stimulation allows the most contractile part of the levator ani to be identified, and, if necessary, the SURFLO can be reinserted to be in the optimal position.

Because the SURFLO is inserted from the outside under direct laparoscopic vision from the inside, there is minimal risk of the cannula missing the posterior rim of the levator ani, which, in patients with High anomaly, lies more anteriorly.

If there is doubt about where to place the SURFLO because the sphincter complex may only be several millimeters wide, laparoscopic electro stimulation can be repeated until the optimal position is identified. Without using this technique, positioning of the pull-through colon could be somewhat random. This technique thus enhances accuracy.

While Yamataka et al applied the 12mm Pena Muscle Stimulator, Iwanaka[8] et al in 2002 devised a muscle stimulator specific for laparoscopy (5-mm diameter LMS - newly developed by the Division of Medical Engineering, Saitama Children's Medical Center). The laparoscopic muscle stimulator visibly made contact with the puborectal muscle and distinctly showed the center of the puborectal sling. Subsequent blunt dissection in the midline of the puborectal muscle presented the center of the top of the muscle complex.

Intraoperative Endosonography

Yamataka et al[36] in 2002 again reported a technique whereby special ultrasonographic endoprobes are inserted during dissection to confirm the location of the center of the external anal sphincter, the muscle complex, and the levator ani muscle sling.

During LAARP, 2 types of rotating ultrasonographic scanners were used to examine the muscles of the pelvic floor using 360° cross-sectional images: one was an endoscopic probe (UM-2R; OLYMPUS, Tokyo, Japan, 12-MHz: penetration depth, 1 to 3 cm; 2.5mm in diameter) and the other was a proctoscopic probe (RU-75M-R1; OLYMPUS, Tokyo, Japan, 7.5-MHz: penetration depth, 2 to 5 cm, 12 mm in diameter).

Each endoprobe had a hard sonolucent plastic cone with a balloon at the tip to allow the probe to fit snugly within the pull-through canal once instilled with normal saline. After the intrasphincteric dissection had progressed to a level 15 to 20 mm deep to the proposed position of the neoanus, the endoscopic (smaller diameter) probe was inserted into the dissected plane to confirm it was surrounded symmetrically by the external anal sphincter. If the muscle layer was not symmetrical in the position it was inserted in, it was reinserted until it was in the center of the sphincter. If the probe gave an adequate reading, dissection was continued further cranially using a pair of mosquito forceps.

The probe was inserted again to check whether it was in the center of the muscle complex and inserted again in the levator ani. Thus, he measured the thickness of the surrounding muscle tissue with the small or large endoprobe, in at least 3 levels: the external anal sphincter, the intervening muscle complex, and the levator ani muscle sling.

Dissection progressed guided by the results of endosonography, and the laparoscopic surgeon eventually saw the tip of the mosquito forceps beginning to pierce through between the two bellies of the levator muscle sling in the midline.

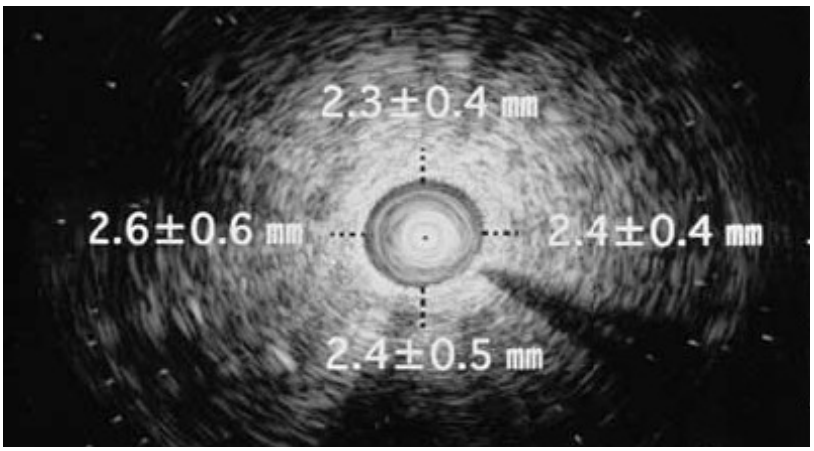
During dissection of the intrasphincteric plane, the probe also was used to identify the urethral catheter and could be used to guide the dissection away from the urethra if dissection accidentally progressed toward the urethra. Thus use of ultrasonographic endoprobes also greatly reduces the risk of injury to genitourinary structures during LAARP.

Once the correct route for the pull-through canal had been established, dilatation was commenced by passing a series of dilators along the guide wire inserted by the laparoscopic surgeon to create the final pull-through canal.

The larger diameter proctoscopic probe then was inserted to confirm that all the pelvic floor muscles (the external anal sphincter, the muscle complex, and the levator sling) surrounded the pull-through canal symmetrically. Final muscle thicknesses measured in various directions (i.e., anteriorly, on the left, posteriorly, and on the right of the rectum) were compared at three levels and analyzed using the unpaired *t* test.

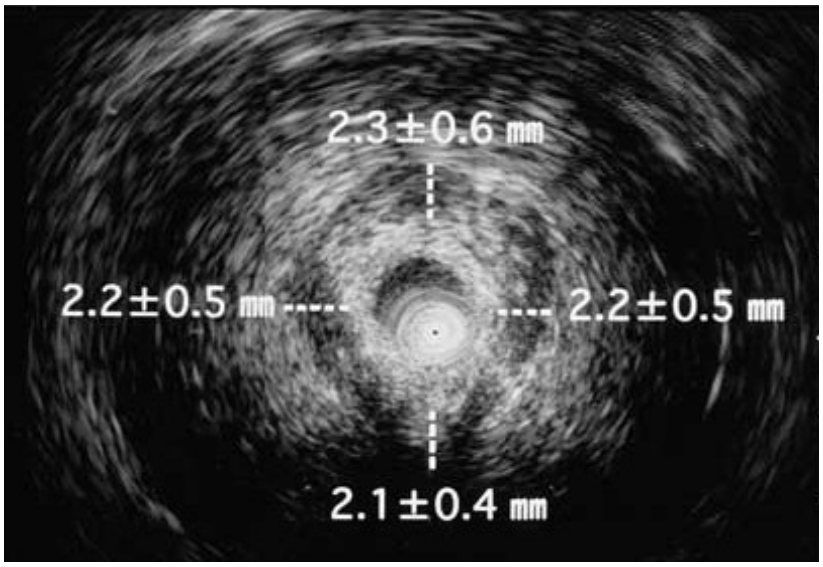
He documented that the average thickness of the **external anal sphincter**, which was seen as a hyper echoic band endosonographically, was

2.3 +/- 0.4 mm anteriorly, 2.4+/- 0.4 mm on the left, 2.4+/- 0.5 mm posteriorly, and 2.6+/- 0.6 mm on the right.



Endosonographic image at the level of external sphincter

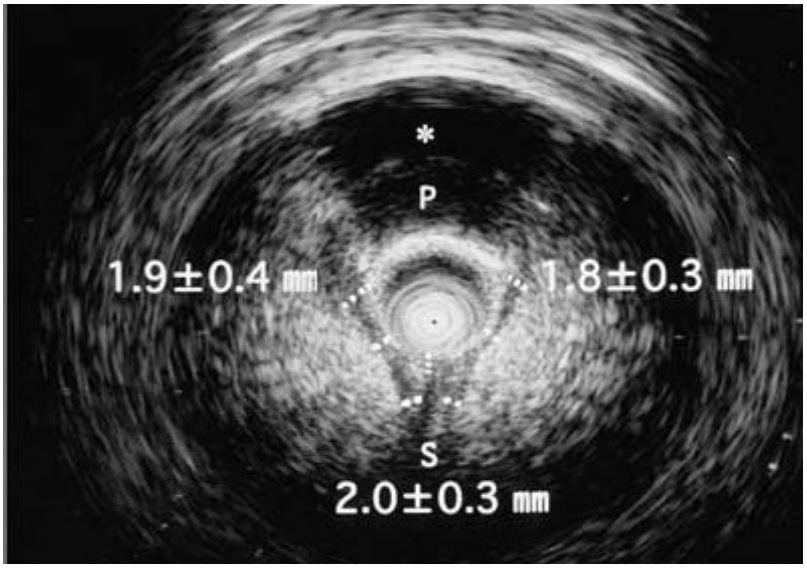
The average thickness of the **muscle complex,** which was seen as a well-defined uniform hypo echoic band endosonographically, was 2.3 +/- 0.6 mm anteriorly, 2.2+/- 0.5 mm on the left, 2.1+/- 0.4 mm posteriorly, and 2.2 +/- 0.5 mm on the right.



Endosonographic Image at the Level of Muscle Complex

The thickness of the levator muscle, which was seen as an Hypo echoic

band endosonographically, was 1.8+/- 0.3mm at the left crus, 1.9+/- 0.4 mm at the right crus, and 2.0+/- 0.3 mm at the rim posterior to the rectum.



Endosonographic image at the level of levator Ani

The muscle complex is a funnel of muscle extending from the levator muscle to the external anal sphincter at the anal dimple. It interdigitates with both the levator and sphincter muscles. By stimulating the anal muscles of the perineum transcutaneously, and the levator sling laparoscopically, the center of the external anal sphincter at the level of the anus and the levator muscle at the level of the pelvis could be identified.

However, during LAARP, the center of the muscle complex cannot be observed from above, i.e., intraabdominally, nor from below, i.e., perineally. This particular technique allows the center of the muscle complex to be identified accurately intraoperatively.

He used two types of ultrasonographic probes for this operative technique. The smaller diameter endoscopic probe was sensitive enough to provide an endosonographic image of all the pelvic floor muscles of interest, i.e., the external anal sphincter, the muscle complex, and the levator sling, but the visual resolution of the larger diameter probe was superior and also could be used to confirm that there had been no damage of the pelvic floor muscles (such as splitting) secondary to dilatation.

All measurements during dissection, before dilatation, can be made using the smaller probe, but the larger probe is required after the pull-through canal is dilated because the smaller probe no longer fits snugly in the dilated canal. Similarly, the length of the sphincter complex cannot be measured accurately because endoprobes that measure linearly do not have balloons.

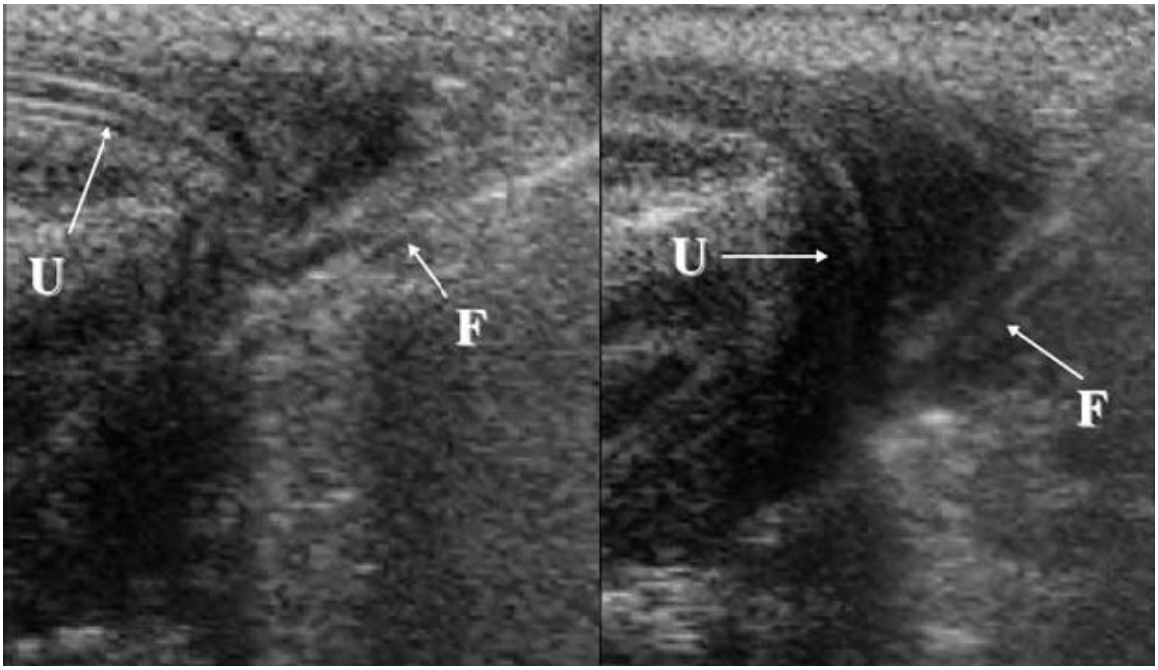
In an another study by Horisawa et al[28] examined sphincter muscles in patients with imperforate anus using 3-dimensional computed tomography before colon pull-through and found that in high imperforate anus, the muscle tissues between the bottom of the levator ani and the caudal muscle complex formed an extremely thin sagittal plate that was only 2 to 3 mm thick. The muscle thickness documented by Yamataka et al is very much comparable with this study.

The use of ultrasonographic probes to identify muscle complex is not new.

Way back in 1993 Saeki et al[29] demonstrated usefulness of intraoperative ultrasonography[30] in Sacroperineal anorectoplasty. Saeki applied an ultrasonic probe over the subcutaneous tissue dorsal to the muscle complex after a posterior sagittal incision was made. Guided by that he created a pull through canal.

Akio Kubota et al[14] in 2004 described a technique to create a accurate pull through canal using **conventional ultrasonographic probe** in the perineum. The anal area was mapped externally with the Pena Muscle Stimulator. The center of the muscle contraction was identified, over which a 1.2-cm skin incision was made, and the perineal part of the PTC was created by insertion of a hemostat forceps into the center of the muscle contraction shown by electro stimulation.

An ultrasonographic probe (9-MHz Linear probe, Toshiba, Tokyo, Japan) applied to the perineum to demonstrate the urethra.



The forceps was advanced through the tight space between the urethra and the puborectalis muscle sling, into the pelvic cavity guided by the ultrasonographic image and laparoscopic direct vision. The forceps was replaced by a Penrose drain and then Hegar dilators were inserted into the Penrose drain to dilate the PTC. After the PTC was dilated enough, the distal rectum was pulled onto the perineum, and the anoplasty was performed in the usual manner.

In our study we have followed the technique described by Georgeson et al. We don't have laparoscopic muscle stimulator but we have improvised our conventional diathermy in a low setting current for laparoscopic muscle stimulation & conventional stimulator used for transcutaneous muscle stimulation. We don't have special ultrasonographic probes to identify centre of muscle complex intra operatively, but we have done postoperative anal USG which shows symmetric muscle complex on either side of rectum.

Complications[37]& problems following LAARP can be classified under following headings:

I. **Complications related to general laparoscopy**

A) Anesthesia related complications due to distension medium

B) During induction of pneumoperitoneum

C) During insertion of trocars

II. **Complications specific to LAARP**

A) Intraoperative complications

B) Postoperative complications

I. Complications related to general laparoscopy

(A) Anesthesia related complication:

Hypercarbia:

Mechanism: Pneumoperitoneum is created with Carbon dioxide which can be absorbed. Ventilation is also restricted by Diaphragmatic splinting which leads to CO2 retention.

Diagnosis and management: Monitoring with pulse oximeter and End-tidal CO2 monitor helps in early detection of the problem. Sudden arrhythmias occur in hypercarbia. Pneumoperitoneum may have to be evacuated and patient reverted to supine position if arrhythmias occur.

Prevention: Use of endotracheal intubation with positive pressure ventilation and constant monitoring of SpO2 and End tidal CO2 helps to prevent

hypercarbia. Further we keep the insufflation pressure & flow rate to a minimum particularly in infants to prevent this complication.

(B) During induction of pneumoperitoneum

(1) Extra-peritoneal gas insufflation:

Mechanism: Introduction of Veress' needle into the extra peritoneal space leads to surgical emphysema. Occurs in 2% of cases.

Diagnosis & Management: Diagnosis is by palpable crepitus felt due to bubbles of CO2 under the skin. Diagnosis is confirmed by typical spider-web appearance caused by pre-peritoneal insufflation on introducing telescope. Gas should be allowed to escape and needle re-introduced.

Prevention: Use of open laparoscopy by Hassan's technique with trocar and cannula is preventive**.**

(2) Pneumothorax:

Mechanism: Insertion of veress' needle into pleural cavity when a high site of insertion is chosen.

Diagnosis & Management: Pneumothorax should be suspected when there is difficulty in ventilating the patient. Clinically mediastinal shift to the opposite side with tympanism over the affected side will be present. Procedure should be abandoned and gas allowed to escape. Pleural tube may be required.

Prevention: Veress' needle should be directed away from the diaphragm

(3) Pneumo-omentum:

Mechanism: Penetration of omentum by the Veress' needle. Incidence is about 2%.

Diagnosis & Management: Raised insufflation pressure should give a clue to diagnosis. Confirmed by aspiration test. Tip position should be altered to free the needle from omentum. Condition is innocuous unless omental blood vessel is punctured.

Prevention: By open laparoscopic trocar and cannula placement.

(4) Injury to gastro-intestinal tract:

Mechanism: Predisposed by distension of gastro-intestinal tract or adhesions of bowel to the abdominal wall.

Diagnosis & Management: Aspiration following needle insertion permits early recognition but may be missed. Following features should lead to suspicion of bowel perforation:

- Asymmetric abdominal distension during insufflation
- Faecal odour
- Passage of flatus

When suspected, induction of pneumoperitoneum should be stopped and needle re-sited. GI tract should be examined for perforation. Through & through injury should be ruled out. Faecal soiling warrants laparotomy and repair of bowel. Simple needle penetration can be managed with broad spectrum antibiotics and observation.

Prevention: Nasogastric tube should be placed initially for decompression. Open method of placement reduces the risk of injury in high risk cases.

(5) Bladder Injury:

Mechanism: Incompletely drained bladder is prone for injury during needle insertion.

Diagnosis & Management: In catheterized patients pneumaturia is noted. Needle should be partially withdrawn and pneumoperitoneum continued. Bladder peritoneum should be carefully inspected to ensure that no significant injury has been caused. Simple puncture is managed conservatively.

Prevention: Routine catheterization of bladder and proper siting of the needle should prevent bladder penetration.

(6) Injury to blood vessel:

Mechanism: Omental or mesenteric vessel injury can occur if they lie close to the abdominal wall during blind insertion of the insufflating needle. Occasionally major vessels like aorta, inferior vena cava or common iliac vessels can be injured.

Diagnosis and Management: Vessel injury is suspected if blood returns up the open needle or if free blood is seen in the peritoneal cavity. In a stable patient management is by investigating with a suprapubically placed laparoscope. Veress' needle should be left in situ for localizing the bleed. Minor bleed can be controlled by using diathermy. Major vessel can lead to shock. Injury to aorta, inferior vena cava or common iliac vessels warrants laparotomy through a mid-line incision and vascular repair.

Prevention: Injury to major vessels may be prevented by lifting the abdominal wall, angling the needle towards the pelvis once the fascia is pierced.

(7) Gas Embolism:

Mechanism: Insufflation of gas following unrecognized vascular puncture with Veress' needle leads to gas embolism which can be even fatal.

Management: Patient should be turned to left lateral and Trendlenberg's position. If immediate recovery does not take place, cardiac puncture should be performed to release the gas.

Prevention: Routine use of aspiration test is preventive.

(8) Puncture of liver or spleen:

Mechanism: High insertion of Veress' needle can lead to injury to these structures. More common if above organs are enlarged.

Diagnosis and Management: Aspiration test and high insufflation pressure will point to the incorrect placement of needle. Needle should be withdrawn and re-sited.

(C) Complications during introduction of Trocars and Cannulae:

The causation of injuries is similar to those caused by Veress' needle but the magnitude of injury is greater. The secondary portals should be inserted only under visual control.

(1) Injury to inferior epigastric vessels in the abdominal wall:

Mechanism: Puncture of deep inferior epigastric artery occurs during insertion of secondary trocars and cannulae.

Diagnosis and Management: Blood may be seen spurting across the abdominal cavity or seen dripping from the trocar wound into pelvis. Delayed appearance of a large abdominal wall haematoma may be an indicator. Managed by leaving the cannula insitu, passing a Foley's catheter into the cannula and inflating the bulb for compression and haemostasis. Incision has to be enlarged minimally to access the rectus sheath. Through and through suture in the rectus muscle at the site of bleed will be needed to control bleeding.

Prevention: Prevented by transilluminating the abdominal wall before insertion in a thin patient or by visualizing the artery laparoscopically as it runs later to the obliterated umbilical artery.

(2) Injury to an intra abdominal vessel:

Mechanism: Due to the size of the trocar tip, damage to major vessel may result in profuse bleeding. Small leak from a major vein may be obscured during procedure due to intraabdominal pressure of the pneumopeitoneum and decreased venous pressure.

Diagnosis and Management: Major vessel bleed leads to severe blood loss and shock. Minor leaks in major veins may be concealed initially and hence to be sought for at the end of any procedure if haematoma is seen or there is an entry point in the posterior peritoneum. Management is resuscitation, laparotomy and vascular repair.

(3) Injury to hollow viscus:

Mechanism: During insertion of primary trocar, hollow viscus injury can vary from superficial damage of serosa to complete passage of trocar right through the loop of bowel. More common in patients with adhesions due to previous surgery (colostomy).

Diagnosis and Management: It is always important to inspect the bowel at the axis of insertion of the primary trocar. If the cannula remains within the lumen, injury will be obvious by the appearance of mucosal folds. In through and through injury diagnosis is by presence of faecal spillage or faecal smell when pneumoperitoneum is released. It may be missed initially and diagnosed due to peritonitis in the post operative period. Managed by laparotomy, peritoneal lavage and closure of perforation or resection & anastomosis.

II. Complications specific to LAARP

(1) Injury to the Rectum:

Mechanism of Injury: During rectal dissection at peritoneal reflection, dissecting close to bowel leads to accidental colotomy. Use of monopolar diathermy during this dissection can cause lateral thermal injury to bowel.

Diagnosis: Colonic injury can be visualized immediately if colon is opened during sharp dissection. But in case of indirect thermal injury diagnosis is

difficult and often presents late. It manifests as peritonitis in the post operative period due to peritoneal contamination.

Management: Bowel injury if diagnosed intraoperatively should be repaired. In cases of late presentation, proximal diversion is a must if it occurs after a single staged procedure with or without closure of perforation. Peritoneal toileting is a must.

Prevention: Use of bipolar diathermy during dissection prevents lateral thermal damage. Careful anterior and lateral dissection should be performed at a safe distance from the rectum.

(2) Injury to Ureter and Vas deferens:

Mechanism: While trying to avoid colotomy during rectal dissection, staying too far away from the bowel can lead to ureteric injury. Inadequate bladder retraction obscures the view at the base of bladder, leading to inadvertent injury to ureters and vas deferens near the bladder.

Diagnosis and management: Intraoperatively identified on visualizing the pulsatile urinary leak from the injured ureter. Late presentation is with urinoma or sudden onset hydroureteronephrosis detected by sonography. In both conditions ureteral stenting is the treatment of choice.

Preventation: Adequate bladder retraction by placing additional suprapubic trocar offers better visualization of structures around the base . Novel way of retraction is by a transabdominal suture taken with the bladder and used for retraction from exterior.

(3) Injury to the urogenital structures:

Mechanism: Injury to the urethra in males and vagina in females can occur during division of the fistula and placement of clips or ligatures. Injury to both urethra and prostate occurs during anterior dissection of the rectum below the peritoneal reflexion.

Diagnosis and management: It may not be identified during surgery. Urethral injury heals with stricture and patient presents with voiding difficulty. Confirmed by anterior urethrogram. Prostatic injury causes bleeding during surgery.

Urethral injury if identified during surgery should be managed with urethral catheter, which should be left in situ for minimum 2 weeks. Patients presenting with stricture will require dilatation, if unsuccessful, internal urethrotomy may be required.

Prevention: Staying close to the rectum during anterior dissection prevents these. Anterior dissection should be stopped on reaching prostatic urethra in males and cervix uteri in females. Fistula should not be divided flush with the

urethra or vagina. A small cuff of fistulous tissue should be left of the urethra or vagina. But urethral diverticulum can occur if one stays too far from urethral wall.

One of the following maneuvers can be used to prevent urethral injury:

1. Metal sound in the urethra can aid in the dissection.
2. Simultaneous use of Cystoscopy & Vaginoscopy for illuminating the urethra & vagina helps in dissection as suggested by Iwanaka et al.
3. Self illuminating urethral catheters placed as guide also helps to prevent urethral injury.

In our experience dividing the fistula without ligation has been safe.

(4) Bladder injury:

Mechanism: Injury commonly occurs during perineal part of the dissection. It occurs while piercing muscle complex with Veress needle. It can also occur in cases of rectovesical (bladder neck) fistula if the pathology is not identified earlier.

Diagnosis and Management: It can be identified by the abdominally placed laparoscope during insertion of veress needle from the proposed anus site. In case of rectovesical fistula preoperative distal cologram helps to identify the pathology earlier & proper care can be taken during rectal mobilization. Rent in the bladder should be closed immediately and allowed to heal with continuous bladder drainage.

Prevention: Use of good endoscopic back light as guide during the perineal procedure should be practiced. Retraction by a transabdominal suture taken with the bladder from exterior also prevents this complication.

(5) Inability to mobilize distal pouch:

Mechanism: Improperly low placement of sigmoid loop colostomy during neonatal period.

Diagnosis and Management: It can be confirmed only after mobilization of the distal pouch. Managed by shifting the colostomy more distally. Other option is, colostomy can be closed and recited at a proximal level for gaining distal loop length.

Prevention: Preoperative distal loopogram is a must for assessment of loop length and planning the procedure.

(6) Bowel torsion:

Mechanism: During pull through across muscle complex inadvertent bowel twist can occur.

Diagnosis and management: Detected by Abdominally placed laparoscope & Inability to pass dilator from below. Corrected by reorienting the lie.

Prevention: A laparoscopic intracorporeal seromuscular suture on the anti-mesenteric border for orientation of the bowel helps to prevent it.

B) Postoperative complications

(1) Immediate complications

(a) Rectal necrosis

Mechanism: This complication can occur if the tract is not adequately dilated, if the distal vascular branches are sacrificed or injured during mobilization of distal rectum and a bowel twist not recognized earlier.

Diagnosis and Management: This is a fearsome complication diagnosed by fowl smelling discharge from the neo anus site, fever & prolapse of necrosed bowel. Initial management consists of antibiotics & debridement. Later when neoanus site heals with scarring revision pull through may be required.

Prevention: Preventing bowel twist, pull through in a adequately dilated tract , avoiding injury to the terminal branches of rectum & avoiding tight packing of neo anus after surgery prevents this complication.

(a) Retraction of rectum

Mechanism: Inadequately mobilized bowel, doing anoplasty with undue tension, inadequate number of sutures while doing anoplasty can lead to this.

Management: In case of minimal retraction posterior skin flap triangular anoplasty would be suffice. Otherwise a revision pull through may be needed.

Prevention: At least 16 interrupted sutures should be placed during anoplasty. Adequacy of mucous fistula should be ensured in the first stage of procedure by constructing the colostomy at the proximal most part of sigmoid loop. Adequate mobilization should be done during LAARP to ensure tension free anoplasty.

(b) Anal stenosis:

Mechanism: Inadequately dilated muscular tunnel can lead to ischemia and subsequently anal stenosis.

Management: Posterior triangular anoplasty would be suffice.

Prevention: Doing a pull through in an adequately dilated pull through canal & maintaining the vascularity of terminal bowel prevents this.

c) Mucosal prolapse:

Mechanism: Redundancy of the pulled bowel or developmentally poor muscular sling leads to this.

Management: Excision of the redundant mucosa & revision anoplasty to be done preferably after the third stage.

Prevention: Can be prevented by suturing rectum to presacral fascia while placing cephalad tension. It also lengthen skin-lined anal canal.

d) Adhesive intestinal obstruction:

Mechanism: This can occur if there is a peroperative spill of distal rectum contents particularly barium which was done for distal cologram earlier.

Management: Conservative treatment with NPO, IVF, antibiotics is curative in most of cases. Laparotomy may be required in prolonged obstruction.

Prevention: Pre & per operative thorough distal loop wash is a must prior to LAARP. Even on the day of distal cologram being done steps must be taken to completely clear the barium, otherwise it may get inspissated & solidified.

e) Others:

1. Port site infection
2. Port site herniation of omentum.

(2) Late complications & other issues

1. Urethral diverticulum
2. Incontinence
3. Constipation
4. Neurogenic Bladder
5. Stricture of Neoanus
6. Prolapse of neoanus (mucosa or full thickness)
7. Perineal Rash.

(1) Urethral diverticulum

Mechanism: Dividing the recto urethral fistula too far away from the fistulous site may lead to this specific complication of LAARP.

Diagnosis and Management: Recurrent urinary tract infection & sometimes dribbling of urine after normal voiding should arouse suspicion. MCU clinches the diagnosis. Excision or plication of diverticulum may be needed.

Prevention: Dividing the recto urethral fistula flush with urethra at a safe distance from urethra avoiding urethral injury at the same time prevents this complication.

(2) Incontinence:

Mechanism: Faecal incontinence can classified as patients who are fit for reoperation, who will benefit from bowel management program and pseudo incontinent patients (delayed onset of continence after a period of continence). Sphincter hypoplasia, sacral agenesis, altered proprioception and altered recto sigmoid motility can be the cause of constipation which cannot be correctible by surgery.

Diagnosis and Management: Following investigations are done for patients with incontinence:

- X-ray sacral spine to rule out sacral agenesis.
- Barium enema to assess stenosis or rectal dilatation
- CT pelvis to assess the position of rectum in relation to levator ani.

- MRI to evaluate spinal cord
- Anal manometry to detect inhibitory recto anal reflex and rectal sensitivity.

Patients with good sphincters, normal sacrum but with misplaced rectum should undergo reciting of the rectal pouch in the levator ani sling. In anatomically poor prognosis defects, bowel management programme should be initiated which includes laxatives and regular rectal enemas. Malone Ante grade Continence enema may be required for complete colonic emptying to produce continence. Permanent colostomy may be only alternative of above procedures fail.

Prevention: For proper placement identify pelvic musculature by its sling shot appearance and laparoscopic muscle stimulator. Skin lined anal canal should be present.

(3) Constipation:

Mechanism: Constipation can be attributed to anal stenosis, disordered colonic motility, initial dilatation of rectal pouch and impaired sensation of rectal fullness.

Management: Requires methodical approach by bowel management programs. Treatment should be for 6 months to 1year and should be started early to prevent mega rectum. Ensure complete bowel evacuation with enemas. Establish effective toilet training, which should aim at 1 to 2 stools per day. Cisapride can be used to improve colonic motility. Biofeedback is useful if rectal sensation is preserved.

(4) Neurogenic Bladder:

Mechanism: Injury to pelvic nerves during anterior dissection can lead to this. Undue bladder retraction can cause temporary neurogenic bladder. Other factors such as sacral agenesis may also contribute to this complication. But when compared to PSARP patients the incidence of neurogenic bladder in LAARP is less particularly in patients with good sacrum.

Management: CIC, Chemoprophylaxis & anti cholinergic drugs.

CONCLUSION

1. LAARP provides excellent visualization of the rectal fistula and surrounding structures.
2. In our experience dividing the fistula without ligation is safe.
3. Allows accurate placement of the bowel through the anatomical midline and levator sling.
4. Early postoperative recovery, early ambulance & decreased pain to the patient are seen in LAARP patients.
5. Repair of associated defect at operation (i.e., hernia, Identification and repair of cryptorchid testes) is possible.
6. It is minimally invasive and leaves small abdominal & perineal wounds.
7. We have found LAARP is an alternative and more effective technique for high ARM over conventional methods.
8. Earlier appearance & higher incidence of recto anal relaxation reflex is noted in LAARP patients.
9. Long term follow up is essential for evaluation of final results.

BIBLIOGRAPHY

1. deVries PA, Pen˜a A: Posterior sagittal anorectoplasty. J PediatrSurg 17:638-643, 1982

2. Georgeson KE, Inge TH, Albanese CT. Laparoscopically assisted anorectal pull through for high imperforate anus — A new technique. J Pediatr Surg 2000, 35:927-931.

3. RK Raghupathy, PK Moorthy, G Rajamani, V Kumaran et al Laparoscopically Assisted anorectoplasty for High ARM J IAPS Oct-Dec 2003, 8; 202-207

4. Sydorak RM,Albanese CT Laparoscopic repair of high imperforate anus. : Semin Pediatr Surg. 2002 Nov;11(4):217-25

5. Pena A, de Vries PA. Posterior sagittal anorectoplasty; important technical considerations and new applications. J Pediatr Surg 1982; 17:796- 811.

6. Ymataka A, Segawa O, Yoshida R, et al. Laparoscopic muscle electro stimulation during laparoscopy-assisted anorectal pull through for high imperforate anus. J Pediatr surg 2001, 36:1659-1661.

7. Alexander Holschneider, John Hutson, Albert Pen˜a : Preliminary report on the International Conference for the Development of Standards for the Treatment of Anorectal Malformations,Journal of Pediatric Surgery (2005) 40,1521- 1526

8. Iwanaka T, Arai M, Kawashima H, et al. Findings of pelvic

musculature and efficacy of laparoscopic muscle stimulator in laparoscopy-assisted anorectal pull-through for high imperforate anus. Surg Endosc 2003;17:278- 81.

9. Iwanaka T, Arai M, Kawashima H, et al. Laparoscopically assisted anorectal pull-through for rectocloacal fistula. Pediatr Endosurg Innov Tech 2002;6:261- 7.

10. Hakgüder, O. Ateş Unique Opportunity for the Operative Treatment of High Anorectal Malformations: Laparoscopy Eur J Pediatr Surg 2006; 16: 449-455.

11. Lin CL, Wong KKY, Lan LCL, et al. Earlier appearance and higher incidence of the rectoanal relaxation reflex in patients with imperforate anus repaired with laparoscopically assisted anorectoplasty. Surg Endosc 2003;17:1646- 9.

12. Lima M, Tursini S Laparoscopically assisted anorectal pull-through for high imperforate anus: three years' Pediatr Endosurg Innov Tech 2005

13. Atsuyuki Yamataka, Laparoscopically Assisted Anorectovaginoplasty for Selected Types of Female Anorectal Malformations J Pediatr Surg 38 :1770-1774.

14. Akio Kubota*, Hisayoshi Kawahara, Laparoscopically assisted anorectoplasty using perineal ultrasonographic guide A preliminary report Journal of Pediatric Surgery (2005) 40,1535-1538

15. Keily EM, Pen˜a A: Anorectal malformations, in O'Neill JA, Rowe MI, Grosfeld JL, et al (eds): Pediatric Surgery. St. Louis, MO,

Mosby, 1998, pp 1445-1448

16.Kiesewetter WB, Nixon HH: Imperforate anus. I. Its surgical anatomy. J Pediatr Surg 2:60-68, 1967

17.Stephens FB: Imperforate anus: A new surgical technique. Med J Australia 2:202, 1953

18.Rehbein F: Imperforate anus: Experiences with abdominoperineal and abdomino-sacro-perineal pull-through procedures. J Pediatr Surg 2:99-105, 1967.

19. Kiesewetter WB: Imperforate anus: II. The rationale and technic of the Sacroabdominoperineal operation. J Pediatr Surg 2:106-110,1967

20.Albanese CT, Jennings RW, Lopoo JB, et al: One-stage correction of high imperforate anus in the male neonate. J Pediatr Surg 34:834-836, 1999

21.Alberto Pen˜ a, Laura Chaves, Urologic Injuries Associated With Repair of Anorectal Malformations in Male Patients Journal of Pediatric Surgery, Vol 37, No 3 (March), 2002: pp 339-344

22.Nagasaki A, Ikeda K, Hayashida Y, et al. Assessment of bowel control with anorectal manometry after surgery for anorectal malformation.Jap J Surg 1983;14:229- 34.

23.Yuzuo Bai, Zhengwei Yuan, Quality of Life for Children With Fecal Incontinence After Surgically Corrected Anorectal MalformationJ Pediatr Surg 35:462-464

24.R.J. Rintala and H.G. Lindahl, Fecal Continence in Patients Having Undergone PSARP ,J Pediatr Surg 36:1218-1221.

25.Tsuji H, Okada A, Nakai H, et al. Follow-up studies of anorectal malformations after posterior sagittal anorectoplasty. J Pediatr Surg 2002;37:1529- 33.

26.Lambrecht W, Lierse W. The internal sphincter in anorectal malformations. Morphologic investigation in neonatal pigs. J Pediatr Surg 1987, 22:1160-1168.

27.Information sheet for Model PS-1 Pen˜a Muscle Stimulator and Probe, Radionics, Inc, Burlington, MA

28.Horisawa M, Niinomi N, Ogura Y, et al: Analysis of 3-D CT images of anal sphincter in imperforate anus. Presented at the 8th annual meeting of the International Meeting of the Pediatric Colorectal Club, Kyoto, Japan, April 2-4, 2001

29.Saeki M, Hagane K, Nakano M, et al. Sacroperineal anorectoplasty using intraoperative ultrasonography: a preliminary report. J Pediatr Surg 1993;28:779- 81.

30.Saeki M, Nakano M, Kuroda T. Sacroperineal anorectoplasty using intraoperative ultrasonography: evaluation by computed tomography.J Pediatr Surg 1994;29:1484- 6.A. 1538

31.Benno M. Ure, Nikolaas M.A. Bax, Laparoscopy in Infants and Children: J Pediatr Surg 35:1170-1173.

32.Carmelo Romeo, Pietro Impellizzeri, Peritoneal Macrophage

Activity After Laparoscopy or Laparotomy: J Pediatr Surg 38:97-101.

33. Zhengwei Yuan, Yuzuo Bai, Neural Electrophysiological Studies on the External Anal Sphincter in Children With Anorectal Malformation J Pediatr Surg 35:1052-1057.

34. Felix Schier, Udo Krebs, Three-Dimensional Reconstruction of the Anorectal Continence Organ in a 14-Week-Old Fetus: J Pediatr Surg 37:912-915

35. Lambrecht W, Lierse W. The internal sphincter in anorectal malformations. Morphologic investigation in neonatal pigs. J Pediatr Surg 1987, 22:1160-1168

36. Yamataka A, Yoshida R, Kobayashi H, et al. Intraoperative endosonography enhances laparoscopy-assisted colon pull-through for high imperforate anus. J Pediatr Surg 2002;37:1657-60

37. Iwanaka T, Uchida H, Kawashima H, et al. Complications of laparoscopic surgery in neonates and small infants. J Pediatr Surg 2004;39:1838-40

PROFORMA

S.NO.

NAME: AGE/SEX PS.NO. IP.NO.

ADDRESS DATE OF REGISTRATION:

D.O. A. D.O.S. D.O.D

TYPE OF FISTULA

STAGED REPAIR/SINGLE STAGE

COLOSTOMY AT BIRTH: YES/NO

PREOPERATIVE INVESTIGATIONS:

ECHO /USG /DISTAL COLOGRAM /MCU

ASSOCIATED ANOMALIES

AGE AT LAARP

PEROPERATIVE PROBLEMS

POST OPERATIVE PERIOD

FOLLOW UP: CLINICAL/ ANALUSG /CT PELVIS/ MRI PELVIS

RESULTS: VOLUNTARY BOWEL MOVEMENTS (YES/NO)

SOILING – GRADE 1, 2, 3

CONSTIPATION – GRADE 1, 2, 3